

## **Historic, archived document**

Do not assume content reflects current scientific knowledge, policies, or practices.

# U. S. DEPARTMENT OF AGRICULTURE

FARMERS' BULLETIN No. 1396

Has been rev.  
--see rev.ed.  
binders at  
end of file.

## *The* DASHEEN

A SOUTHERN  
ROOT CROP FOR  
HOME USE AND  
MARKET



ONLY TWO distinctly starchy vegetables, the potato and the sweet potato, are commonly grown in the United States. A fall-maturing crop of the same character—the dasheen—was introduced a number of years ago for cultivation in the Southern States, primarily to supplement the small supply of home-grown potatoes. Most of the potatoes used in the far South are shipped from the North, and a part of this need might well be met by dasheens locally grown.

The foreign populations of our larger cities formerly used considerable quantities of dasheens and related vegetables imported from the Orient and the West Indies. This market is now supplied largely by dasheens grown in the Southern States.

Dasheens are used generally for home consumption by hundreds of growers and to a small extent by native Americans in a number of cities. Conservatism in food habits and the frequent marketing of dasheens of unattractive appearance or inferior quality have prevented a more rapid growth of the market demand. Continuous effort by growers and others in the South to make the excellence of this vegetable known to winter tourists and care in marketing only the best dasheens are calculated to bring about a largely increased demand.

# THE DASHEEN; A SOUTHERN ROOT CROP FOR HOME USE AND MARKET.<sup>1</sup>

By ROBERT A. YOUNG, *Plant Introducer, Office of Foreign Seed and Plant Introduction, Bureau of Plant Industry.*

## CONTENTS.

Page.		Page.
1	Cultivation-----	10
2	Fertilizers-----	13
4	Harvesting-----	14
4	Storage-----	17
7	Marketing-----	18
8	Diseases and insect enemies-----	22
	Uses-----	25
	What the dasheen is-----	
	General description of the dasheen-----	
	Chemical composition and digestibility-----	
	History of the introduction of the dasheen-----	
	Varieties-----	

## WHAT THE DASHEEN IS.

**D**ASHEENS have been grown commercially in the Southern States since 1913. They were cultivated experimentally or for home use by a few persons several years earlier. The Trinidad dasheen—the variety commonly grown in the South—is an especially rich-flavored, mealy cooking, and prolific variety of the Polynesian and oriental taro (*Colocasia esculenta* (L.) Schott). In food properties it is very similar to the potato, but the dasheen contains less water, and in consequence the content of starch and protein is about one-half greater than that of the potato. The name “dasheen” is believed to be a corruption of the French expression “de Chine” (from China),<sup>2</sup> indicating the supposed country of origin of this variety of taro. The full name originally used in the West Indies was probably “taro de Chine” (Chinese taro) or something of similar meaning, but the first part of the name seems to have passed out of use in most, if not all, localities.

Taros, or dasheens, of varieties similar to or identical with the Trinidad dasheen are also known in various parts of tropical America under the names “malanga,” “eddo,” “coco,” “taya,” “tanier,” and “tannia” (also spelled “tanyah” and “tanya”). These names

<sup>1</sup> Previous publications (now out of print) on dasheen culture are as follows:

Barrett, O. W. Yautias, taros, and dasheens. In U. S. Dept. Agr., Bur. Plant Indus. Bul. 164, p. 7-29, pl. 2-10. 1910.

Young, Robert A. The dasheen, a root crop for the Southern States. In U. S. Dept. Agr., Bur. Plant Indus. Cir. 127, p. 25-36, 3 figs. 1913.

— The dasheen, a root crop for the South. U. S. Dept. Agr., Bur. Plant Indus. [Doc.] 1110, 11 p., 4 pl. 1914.

— The dasheen: Its uses and culture. In U. S. Dept. Agr. Yearbook, 1916, p. 199-208, pl. 38-43. 1917.

<sup>2</sup> O. W. Barrett, who was formerly connected with the Office of Foreign Seed and Plant Introduction and who spent some time in Trinidad as well as in other parts of the West Indies, states that the word “dasheen” originated in Trinidad, being an Anglicized form of “da Chine” (pronounced dah-sheen)—the expression used in the French patois of the West Indies spoken by the peasant class of Trinidad. This opinion is confirmed in its essentials by other investigators.

are likewise applied to other types of taros<sup>3</sup> and to some of the yautias (*Xanthosoma sagittaeifolium* (L.) Schott and other species).

The word "taro" (also called kalo in Hawaii) is Polynesian and is so widely known and used that it is better to use this as the common name for the species of *Colocasia* rather than any of the various other names that have come into use in America. Most of these local names have become so firmly fixed for the old familiar varieties, however, that they will probably be displaced only as newer and better varieties under other names are introduced.

### GENERAL DESCRIPTION OF THE DASHEEN.

The dasheen is a broad-leaved member of the arum family (fig. 1), to which belong also the calla and the jack-in-the-pulpit (Indian

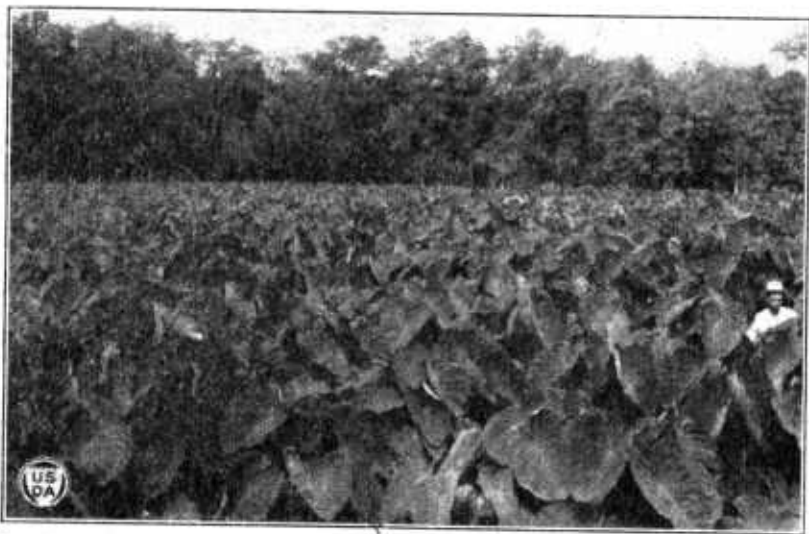


FIG. 1.—A field of the Trinidad dasheen in central Florida, as it appeared in August. The plants are spaced 4 by 3 feet (they can be planted closer) and vary from 5 to 7 feet in height. The soil is known as "hammock," a rather rich sandy loam underlain with stiff clay. Planting is done about March 1, and the crop is ready to harvest in November. This field yielded 350 bushels of dasheens per acre. Two applications of a complete commercial fertilizer at the rate of 700 pounds per acre were given. (P19907FS.)

turnip). It resembles in general appearance its close relative, the ordinary elephant-ear (*Colocasia antiquorum* Schott, often called *Caladium esculentum*). The Trinidad dasheen differs from most other taros in having its corms and cormels (primary and secondary "tubers") practically free from the acidity so common to aroids in general, which is exemplified in the Indian turnip. However, caution should be used in tasting uncooked dasheens, for there is al-

<sup>3</sup>From early colonial times there have been grown in gardens and in other suitably moist spots at various places in our Southeastern States two distinct varieties of taro under the name tanyah (or tanya). One of these taros, often called the "blue" tanyah because the flesh becomes somewhat bluish or violet when cooked, has pink buds and roots. The other variety becomes yellowish when cooked and is called the "yellow" tanyah when it is desired to distinguish between the two. The plants of the latter variety are smaller than those of the first, and the buds and roots are white. Both of these tanyahs, or taros, are acid in the raw state, but the yellow variety is much the more acid and requires boiling for at least two hours to render it edible.

ways the possibility that some acrid taro of similar appearance has become mixed with the nonacrid variety. The leaves of the dasheen are very acrid and should not be tasted except when cooked as greens according to the special directions given on page 33. In cases of the accidental eating or chewing of the leaves or of acrid corms or tubers, the resulting irritation of the mouth and throat is usually relieved by the use of lemon juice in a little water.

There are many varieties, more or less distinct, of taros having the same general habits of growth as the Trinidad dasheen. In view of the origin of the word "dasheen," however, it would be more appropriate to call these varieties "taros" except where there is reason to believe that they are of Chinese origin.

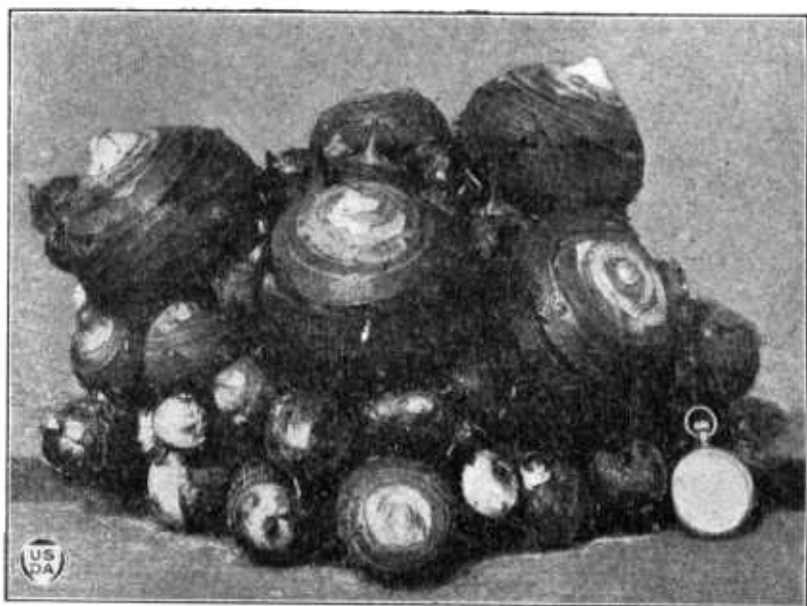


FIG. 2.—A 23-pound hill of the Trinidad dasheen before being broken up, showing the relative position of the corms and tubers (cormels) as they grew. This hill, which is much above the average size, contains five corms instead of the usual one or two. They weighed 12 pounds. There were about 4 pounds of marketable tubers and secondary corms, which with the five corms made 16 pounds of marketable dasheens from this hill. (P19299FS.)

In the dasheen type of taro the tuberous growth (figs. 2 and 3) consists of one or more (according to the number of original sprouts from the material planted) large edible central corms and a considerable number of edible cormels, or lateral tubers, compactly clustered. Both corms and tubers are usually more or less ovoid, but the form varies somewhat with the variety and with the length of the season. Leaves are produced in a whorl by each corm and usually by each of several tubers in a hill. The leaf (fig. 1) is peltate (the petiole, or leafstalk, attached near the center of the blade), erect, and 3 to 7 feet high under suitable conditions; blade ovate to broadly ovate, rather dark velvety green above, and in some varieties with a purplish spot at the point of petiole attachment; the petiole varies in color, according to the variety, from plain

green to light or dark purplish maroon in part or throughout its length.

Dasheen corms vary in weight, with the size and vigor of the plants, from less than a pound to more than 8 pounds each. The tubers vary from less than an ounce to a pound or more each. One or more of these lateral tubers in each hill often attain the size of a small corm and also assume something of its shape and other characteristics. Such tubers are called secondary corms. (Figs. 4 and 5.) In quality the secondary corms closely resemble the primary corms from which they spring. The color of cooked dasheens just beneath the skin is purplish; and the flesh of the corms and of any tubers which may have sent up leaves is frequently more or less tinged with violet, though occasionally it is entirely free from this coloration. The violet-colored dasheens are often of richer flavor than those of creamy or other light shades.

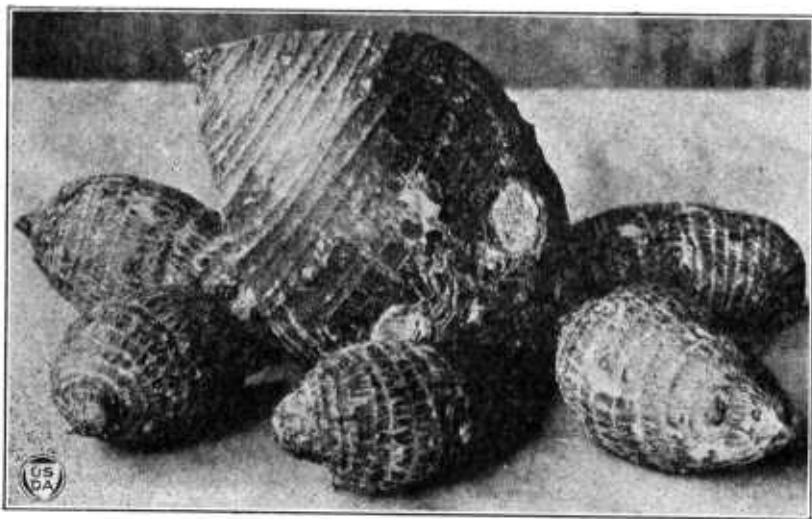


FIG. 3.—A 2½-pound Trinidad dasheen corm and some first-grade tubers suitable for table use or market, weighing 4 to 6 ounces each. (Much reduced.) The two large light spots near the base of the corm are scars where tubers were attached. Dasheen corms and tubers contain 50 per cent more protein and starch than the potato and have a delicate nutty flavor when baked or boiled. (P27548FS.)

### CHEMICAL COMPOSITION AND DIGESTIBILITY.

The composition of dasheens varies slightly with the variety and with circumstances, such as the soil in which they are grown, the length of time in storage, and the temperature and moisture content of the air where stored. Differences in composition due to the latter causes are, of course, mainly in moisture content. The most rapid loss of moisture naturally occurs within the first week or two after the dasheens are dug, the rate of loss depending on the freedom of ventilation and the moisture and temperature conditions of the air. An average of 10 analyses of the edible portions of corms and tubers of the Trinidad dasheen, made in February and March (of different years) by the Bureau of Chemistry of the United States Department of Agriculture, gives percentages as follows:

Water	62.77
Protein	3.03
Carbohydrates:	
Starch	26.09
Soluble sugar	1.75
Pentosans	1.24
	29.08
Ether extract (fat)	.16
Crude fiber	.71
Ash	1.30
Undetermined	2.95
Total	100

The average analysis of the potato gives the protein content as 2.2 per cent and the starch about 18 per cent, the sugar and fat contents

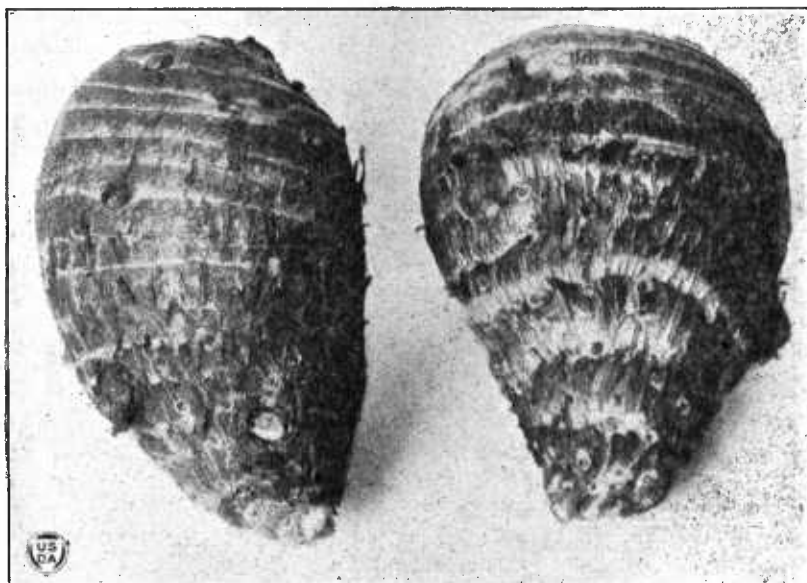


FIG. 4.—Secondary dasheen eorms. (Reduced.) A secondary eorm results when a cormel, or lateral tuber, sends up leaves and gives rise to other tubers. It usually enlarges greatly toward the apex (bud end) and sometimes increases to more than half the size of the parent eorm. Secondary eorms are commonly somewhat flattened on one side (next to the parent eorm), as shown by the side view of the 11-ounce specimen on the left. Secondary eorms vary greatly in size and form, but in quality they always resemble the primary eorm more than a tuber. (P28179FS.)

being negligible. The sugar content of the dasheen is 1 $\frac{3}{4}$  per cent, which accounts for the noticeably sweeter taste of this vegetable in comparison with the potato. In the sweet potato the average starch content is 21.1 per cent, sugar 5 per cent, protein 1.8 per cent, and fat 0.7 per cent. Although the total carbohydrate content of the dasheen is but little above that of the sweet potato, the protein content is more than one-half greater.

The starch grains of the dasheen are among the smallest<sup>4</sup> in food plants. Whether for this or some other reason, dasheens and other taros are reputed in countries where commonly grown to be more

<sup>4</sup> This statement is based on measurements of starch grains of different plants made by Dr. B. J. Howard, of the Bureau of Chemistry, United States Department of Agriculture.



easily digested than other starchy foods. Although there are no published reports of scientific tests to determine just what foundation underlies this popular belief, experience to similar effect is reported by many persons in this country. The question of the completeness of digestibility of dasheens has been investigated, however, by specialists of the department,<sup>5</sup> and the conclusions (repro-

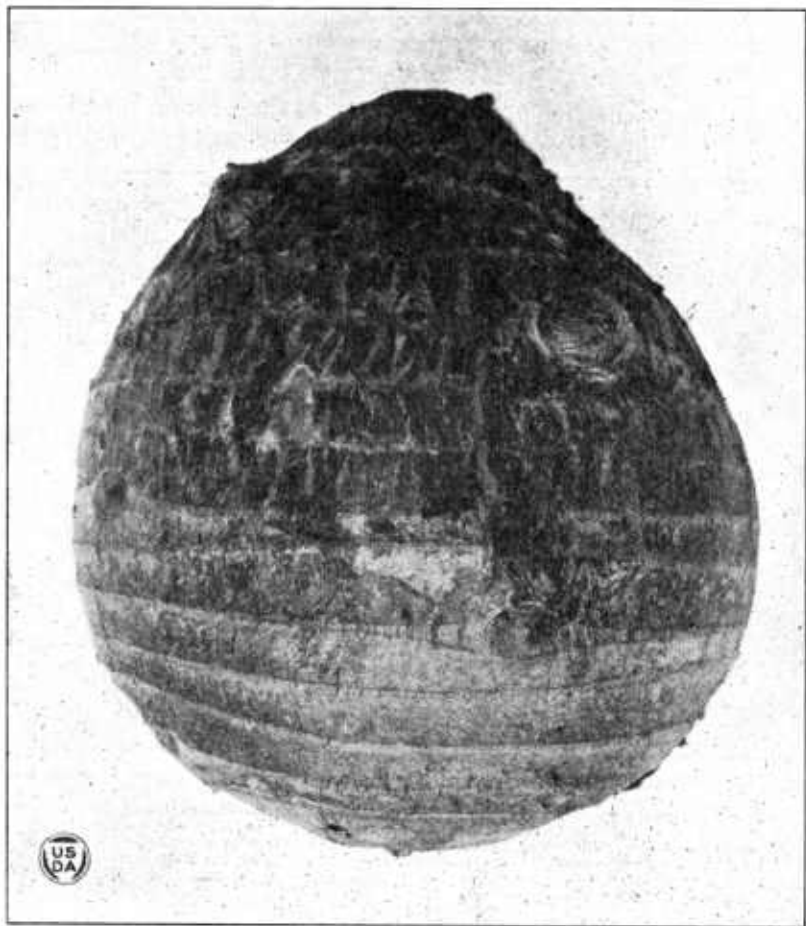


FIG. 5.—Front view (natural size) of the flattened secondary dasheen corm shown on the left in Figure 4. (P28181FS.)

duced from Department Bulletin 612, now out of print) of the investigators are here given:

In 10 digestion experiments with men, mature and immature dasheens were eaten in conjunction with common food materials in a simple mixed diet. The average coefficients of digestibility for the total diet were: Protein, 80.8 per cent; fat, 96.1 per cent; and carbohydrates, 97.6 per cent.

The value obtained for the digestibility of the carbohydrates, 97.6 per cent, which for all practical purposes represents the digestibility of the dasheen

<sup>5</sup>Langworthy, C. F., and Holmes, A. D. The digestibility of the dasheen. U. S. Dept. Agr. Bul. 612, 12 p. 1917. Bibliographical footnotes.

carbohydrates, compares very favorably with that of potatoes, the common vegetable most resembling the dasheen.

The subjects of their own volition ate on an average approximately 1½ pounds of dasheen daily without any observed physiological disturbances, which would indicate that considerable amounts of dasheens may be safely used in the dietary and that they are palatable.

The results here reported were obtained from dasheens cooked by one method only; in the absence of data to the contrary it may be very well assumed that the dasheen is equally well digested when prepared by other methods similar to those employed with potatoes.

The data obtained in this investigation give evidence to justify the belief that the dasheen is a valuable addition to the dietary, that it can replace the potato in those regions where the potato can not be successfully grown or easily obtained, and that it is also valuable for more general use to give greater variety to the diet in other localities.

From this summary of the investigation it is evident that in completeness of digestibility the dasheen does not differ materially from the potato.

## HISTORY OF THE INTRODUCTION OF THE DASHEEN.

The first definitely recorded introduction<sup>o</sup> of the Trinidad dasheen to the mainland of the United States for cultural experiments was from Porto Rico, in 1905. The variety had been previously obtained by the Agricultural Experiment Station, Mayaguez, Porto Rico, from the island of Trinidad. It is believed to have been brought from China to the Western Hemisphere perhaps two or three centuries ago, and it has been cultivated under various names in many of the West Indies. Varieties identical with it in appearance and resembling it in quality have been obtained from Dutch Guiana and Peru.

## BEGINNING OF THE DASHEEN INDUSTRY IN THE UNITED STATES.

The first field tests which showed conclusively that dasheens could be grown successfully in the Southern States were made in 1908 and 1909 in central Florida and near Charleston, S. C. Dasheens have been grown by a gradually increasing number of people in the far South since 1913. In the spring of that year the sending out of seed tubers on a rather broad scale to experimenters was begun by the United States Department of Agriculture.

There has been a small but growing market demand for dasheens since the spring of 1914. Very early in that year the Office of Foreign Seed and Plant Introduction of the Department of Agriculture received a specimen taro obtained at New York from a commercial shipment from Beirut, Syria. It was learned that this taro was being imported for food purposes; as the dasheen was

<sup>o</sup> Catesby, Mark. The natural history of Carolina, Florida, and the Bahama Islands, 2 v., illus. London, 1731-1743. After discussing briefly (under the name *Arum maximum acgypticum*) a very acrid plant which was doubtless one of the tanyabs (see footnote, p. 2) that are still cultivated in the coast region of the Southeastern States, Catesby makes the following statement:

"A little before I left Carolina there was introduced a new Kind, wholly without that bad Quality, and requiring no more than common Time to boil them, and may be eat raw, without offending the Throat or Palate; this was a welcome Improvement among the Negro's and was esteemed a Blessing; they being delighted with all their African Food, particularly this, which a great part of Africa subsists much on."

It is probable that this new nonacrid plant mentioned by Catesby was a variety of taro similar to or identical with the Trinidad dasheen. The account leaves the impression that at the time alluded to the new variety was being cultivated in Carolina. If such was the case, however, the variety was evidently lost to cultivation there later, for no trace of it has been found during recent investigations.

somewhat similar to it and considered to be of superior quality, the question of substituting American-grown dasheens was taken up with the importers. After testing a small sample, these importers expressed entire willingness to purchase the new vegetable and to cooperate in helping to build up a dasheen industry in the Southern States. The season being far advanced, it was possible to obtain only a few hundred pounds of dasheens at that time; but this was the beginning of a regular market demand, which in the season of 1920-21 had increased to an aggregate of about 10 carloads.

#### POSSIBILITIES FOR GROWTH OF THE INDUSTRY.

The extent to which the northern market for dasheens can be increased and the rapidity with which it can be developed remain to be seen. At present the principal consumers of dasheens in our northern cities are the peoples of oriental or tropical origin. A considerable number of Americans, however, have already become accustomed to the more or less frequent use of the vegetable; and it is reasonable to believe that they and many more will come to use dasheens with increasing frequency, provided these appear on the market attractively and regularly. Growers should cooperate with each other to bring about this condition by keeping the existing demand always supplied in season with good dasheens and by refraining from marketing any that are inferior in quality or appearance.

To lengthen the season during which dasheens are available, by storing the surplus part of the crop under suitable storage conditions as soon as harvested and properly cured, would unquestionably lead to materially increased consumption of dasheens each year. In the South, where much of the time the temperature is too high for ordinary storage, a part of the commercial crop has usually been left in the hands of the growers until sprouting or partial decay has taken place, and a satisfactory supply has not been available for the usual late winter and early spring demand. Dasheens can be handled and stored (see p. 17) so that they will keep well without sprouting (fig. 6), at least until late spring. If the dasheen industry is to grow as it deserves, the vegetable must not only be put on the market as early as possible but must be kept there in first-class condition continuously during the season and the season prolonged by proper storage methods to its greatest length.

The making of some manufactured product, such as dasheen chips or crisps (see figs. 23 and 24), on a commercial scale would unquestionably be a great stimulus to the industry. A business of this kind, if undertaken, should be started in proximity to one of the dasheen-growing regions in order to avoid heavy transportation expense on the raw product and to enable the manufacturers to obtain dasheens of suitable grades and quality. The excellence of the chips and crisps when properly made from good dasheens gives reason to believe that it is only a question of time until their commercial manufacture will become established.

#### VARIETIES.

Of the many taros of the dasheen type that have been tested by the United States Department of Agriculture, two besides the Trinidad dasheen have proved of sufficient merit to warrant recommend-

ing them for further trial by growers who are already cultivating the Trinidad variety. It is hoped to give, in a later publication, information concerning other promising taros which will be of interest to southern farmers. Descriptions of the three dasheen varieties follow:

*Trinidad* (S. P. I. No. 15395).—From the island of Trinidad, British West Indies. Leaves erect, 5 to 7 feet high; blade broadly ovate, rather dark velvety green above, with a purplish spot at the point of petiole (leafstalk) attachment, light green beneath; petiole dark green, shaded with numerous bronze or maroon lines—especially on the lower half—and with solid reddish maroon on the shoulder (next to the blade). Corms (figs. 2 and 3) roughly ovoid to nearly spherical; tubers (fig. 7) ovoid to long or irregular; buds reddish or pink; flesh white. Each hill produces from 1 to 5 corms and from 20 to 100 tubers. From 5 to 10 of the tubers give rise to a whorl of leaves, as does also each corm. When the corms are properly grown and cooked the flesh is mealy, rather dry, chestnut flavored, and is cream colored, grayish, or violet. When the tubers are cooked they are slightly moister, lighter in shade,



FIG. 6.—Dasheen tubers photographed the latter part of May, unsprouted after having been in storage nearly six months in an ordinary basement at temperatures ranging between 40° and 55° F. (P35009FS.)

and finer grained than the corms, though often less rich in flavor. This variety is very prolific, ordinarily yielding 250 to 350 bushels per acre in good soil. The yield per hill commonly varies from 4 to 10 pounds of cleaned corms and tubers. In unusually rich and deep sandy loams yields of 20 to 30 pounds from single hills have been recorded.

*Sacramento* (S. P. I. No. 47002).—Obtained in 1913 from a Chinese merchant in Sacramento, Calif. Leaves practically identical with those of the Trinidad variety, but fewer are produced from lateral tubers. The buds of corms and tubers are more reddish than those of the Trinidad; corms usually larger and more regularly ovoid or roundish; the 10 to 15 lateral tubers (fig. 8) are larger and more uniform in size and shape than those of the Trinidad. The corms are variable in quality, sometimes very good, but usually too unreliable for market purposes. The tubers are nearly white when cooked, somewhat moist, and without distinct flavor; but they are of pleasing table quality and become even better in storage. Although the number of lateral tubers to the hill is small, their relatively large size and uniform shape commend the Sacramento dasheen for cultivation when it is not definitely expected to market the corms.

*Ventura* (S. P. I. No. 47003).—Obtained in 1916 from a grower at Ventura, Calif., who had obtained it several years previously from a local Chinese

gardener. Leaves similar to those of the Trinidad variety, but bases of petioles much more reddish. The buds of both corms and tubers are deep red, similar to those of the Sacramento. The corms are slightly smaller than those of the Trinidad variety, but more regular in form; the tubers (fig. 9) are about the size of the average Trinidad tubers, but fewer and usually more uniform in size and shape. The quality of corms and tubers is excellent, similar to that of the Trinidad.

### CULTIVATION.

The dasheen is a long-season crop, adapted for culture only in regions where there is normally a very warm, frostless season of at least seven months. It also needs a rich loamy soil, an abundance of moisture together with good drainage, and a fairly moist atmosphere. As a commercial crop in the United States, therefore, it

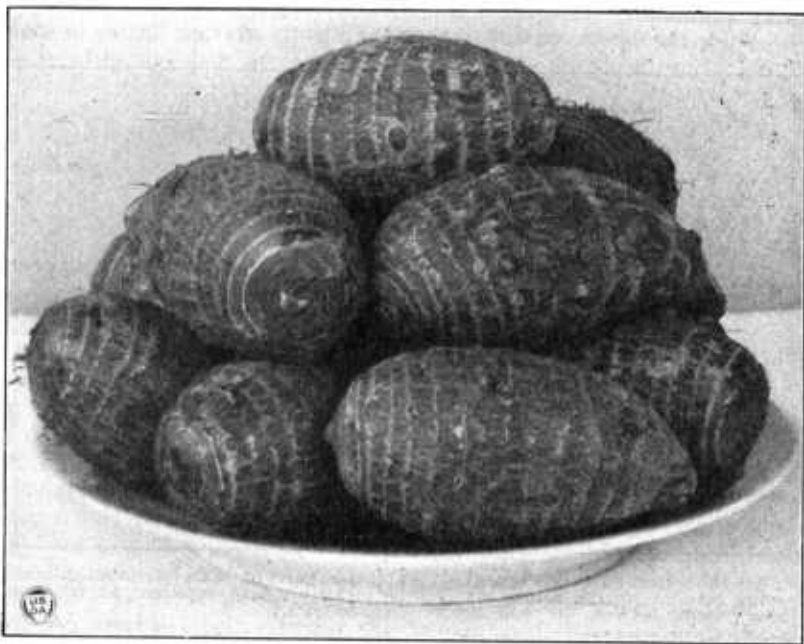


FIG. 7.—Dasheen tubers (reduced), strictly No. 1 grade in shape and size (4 to 7 ounces each), ideal for nearly all culinary purposes. Usually less than one-fifth of the crop consists of such uniform tubers. (125566RS.)

is limited to lands that are comparatively low on the Coastal Plain from South Carolina to eastern Texas.

For the best development of the dasheen, both in quantity production and table quality, a very moist but fairly well-drained rich sandy loam is ideal. Soils similar to those of the hammock lands of Florida are especially suited to this crop. Soils lacking in fertility or moisture give reduced yields, while those poorly drained produce dasheens of such inferior quality as often to be unsuited for table use. The crop is not greatly injured, however, by occasional flooding for short periods.

Some types of muck land (such as some of those of the Florida Everglades) when properly drained yield large crops of dasheens of fair to good quality. Unfavorable weather conditions, however,

often materially lower the quality of the crop by destroying the mealy cooking character. A long drought in the late summer followed by renewed growth of the dasheens or a prolonged wet period during the fall without adequate drainage may make the crop from these soils practically unmarketable for food purposes. The corms are the more seriously injured in quality, though the lateral tubers are somewhat affected. The size of the crop is also reduced.

Planting should be done as early as climatic conditions permit—two weeks or more before the last spring frost is expected. Where the frostless season does not exceed six months, it is well to start the tubers a month earlier inside and set out the plants when danger from frost is past.

It is best to plant tubers weighing from 2 to 5 ounces each, but good results are obtained with much smaller ones if the soil conditions are favorable. Experiments to determine the effect on the resulting crop from the planting of tubers of good and of poor shapes have shown no advantage in selecting those of superior form. For field culture tubers or small corms are planted whole and singly, not more than 2 or 3 inches deep. The top portions of medium-sized or large corms, if available, give strong plants. Tubers or corms

with the terminal buds living are always to be preferred unless it is desired to increase the number of corms raised. If the terminal bud grows, one corm results (fig. 10, *A*); if it fails to grow (fig. 10, *B*), two or more lateral buds usually start, and each produces a corm. Each corm gives rise to lateral tubers.

It is recommended that dasheens be planted in  $3\frac{1}{2}$  or 4 foot rows, about 2 feet apart in the row. Heretofore they usually have been



FIG. 8.—A typical tuber (natural size) of the Sacramento dasheen, weighing  $6\frac{1}{2}$  ounces. This variety produces fewer lateral tubers to the hill than the Trinidad, but the average size is considerably larger, and the tubers are more nearly uniform in size and shape. Tubers of the Sacramento dasheen contain more moisture than those of the Trinidad and are usually not quite so rich in flavor, but they are whiter when cooked. (128142F.S.)

spaced so as to allow about 12 square feet to the plant, but recent experiments conducted by the department show that increased yields may be obtained by planting closer. This practice also results in more complete shading of the ground when the plants become large, thereby tending to reduce the labor of keeping down weeds.

Reasonably deep cultivation of dasheens in the early part of the season is beneficial if soil moisture is sufficient, but from and after midsummer the soil should be gradually drawn to the plants and the ground kept free from weeds by frequent but very shallow cultivation or hoeing. The dasheen is very shallow rooted, and the crop



FIG. 9.—A 4½-ounce tuber (natural size) of the Ventura dasheen. In quality the Ventura dasheen is scarcely distinguishable from the Trinidad, but the lateral tubers are fewer and more uniform in size and shape. (128144FS.)

is easily injured if the surface roots are disturbed. When a few plants only are grown and it is desired to get a maximum yield of dasheens, mulching with dry grass or any kind of litter may be practiced in dry weather to conserve the soil moisture.

Planting dasheens early in February has given good results as far north as the northeastern coast region of South Carolina. A satisfactory method is to turn a 4-inch furrow over the tubers from each side when planted, leaving a ridge over the row. About April 1, or when the weeds have just sprouted, the ridges are broken with a harrow. A second and even a third harrowing often can be given before the dasheen plants are large enough to be injured by this method of cultivation.

Under favorable conditions the plants reach a height of 5 to 7 feet in midsummer, and where frost does not occur after April 1 it is often possible to obtain dasheens for home use early in September. The corms and tubers do not begin to develop rapidly until August. The harvesting of the main crop should be deferred until the first frost or until the growth of the tops practically ceases and the older leaves die.

The corms (usually of marketable size if in good soil) constitute from one-third to more than half the yield of a hill of dasheens, and the tubers suitable for market make one-eighth to half the total

weight. With a total yield of 250 bushels per acre, the merchantable crop therefore may be from 100 to 150 bushels, depending in part upon the closeness of grading. The remainder, sometimes as much as half the yield, consists of tubers unsuitable for market because of size or shape. As a rule, the larger the yield, the higher the proportion of first-grade tubers. With a low rate of yield there may be almost no tubers of this grade and very few corms large

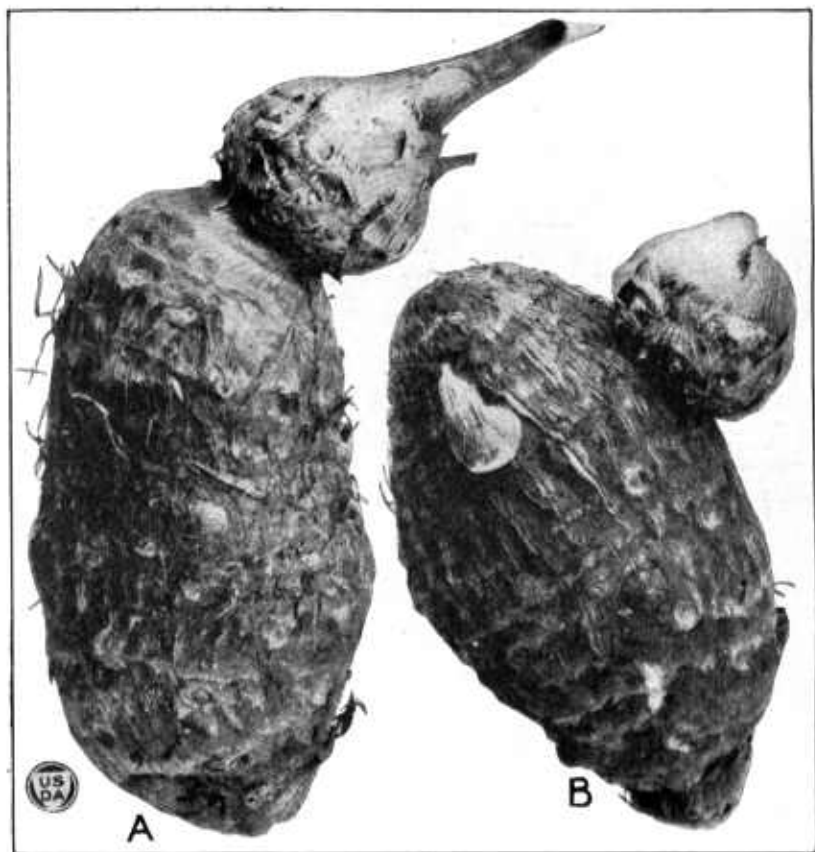


FIG. 10.—Sprouted dasheen tubers. A corm is developing from the terminal bud of the tuber (A) on the left. The terminal bud of the right-hand tuber (B) was destroyed, and two laterals have sprouted. From one to five, or even more, lateral buds may begin to grow from a corm or large tuber if the terminal dies. (127532FS.)

enough for market. This fact emphasizes the importance of securing as heavy a yield as possible on whatever area is grown.

### FERTILIZERS.

An abundance of humus in the soil is essential for successful dasheen culture. For this reason the turning under of a soiling crop—preferably a legume—beforehand or of a liberal quantity of well-rotted barnyard manure at planting time is advised when practicable. This may be supplemented, especially when a good sup-



ply of manure is not available, by the application of a commercial fertilizer of high potash content. In most soils suited to dasheens the use of a complete fertilizer seems to be justified by the increased yields. At the Plant Introduction Garden, Brooksville, Fla., where the crop was grown on hammock land, a fertilizer approximating the following formula has been used with good results: Ammonia, 4 per cent; phosphoric acid, 6 per cent; potash (as sulphate), 10 per cent. About 700 pounds per acre are used in each of two applications, the first soon after planting and the second early in July. Hardwood ashes (unleached) also may be used, at the rate of 1,000 to 1,500 pounds per acre, if there is a shortage of potash from other sources.



FIG. 11.—Turning over dasheens with a 10-inch plow at Brooksville, Fla. After being turned out the clumps are broken apart, most of the soil shaken from the roots, and the plants usually left on the ground to dry from one to three days before the tops and roots are removed. (P10768FS.)

## HARVESTING.

### DIGGING.

Harvesting dasheens, for the present at least, is more costly than for potatoes because of the hand labor required in separating, cleaning, and sorting them. A 10-inch plow has proved satisfactory for turning the plants over (fig. 11) when the area grown is large enough to justify its use. If the crop is not heavy an 8-inch plow may be large enough, or a furrow may be turned away from one or both sides of the row to facilitate digging by hand. Small hills are easily lifted with a potato fork; but with larger ones the work is much more quickly done by two men with long-handled, round-pointed shovels. With very large plants, if the tops are still stand-

ing and especially if furrows have not been run along the rows, it may be advisable to have a third man grasp the tops and pull the plant over as it is loosened and lifted with the shovels (fig. 12). Some growers cut off the tops within a few inches of the ground before digging the crop. The question as to whether this is better than removing them later seems to be one of individual preference.

Even on rather sandy land, the numerous fibrous roots hold the soil so firmly that a clump of dasheens can not well be separated



FIG. 12.—Digging dasheens by hand. Two men lift the clump with long-handled round-pointed shovels, while the third pulls it by the tops and lays it on its side. Two men can do the work, or even one, where the plants are small; but where the plants are as large as those shown three men can work about twice as rapidly as two. Hand digging is to be preferred to plowing if the area is small or if root-knot is suspected and it is desired to select tubers from disease-free hills for seed purposes. (P19270FS.)

except by hand. If the tops are still attached, these may be grasped and the clumps thoroughly shaken to dislodge as much of the soil as possible; they can then be broken apart by means of the tops. The potato fork can not be used to break the clumps without danger of injury to many of the best corms and tubers. In dry weather, if the sun is not too hot, the dasheens with tops attached may be left on the ground for one to three days to dry. The tops and feeding roots having then become more or less withered are much more easily removed than when the plants are first dug.

It is highly desirable to harvest the crop during dry weather, if possible, as it is of the utmost importance that the tubers have time to dry well in the open air before being shipped or stored. They should not be exposed to frost, however. The packing or storing of dasheens without adequate drying or curing is likely to result in considerable loss through storage rots. If the weather or other circumstances make it impracticable to dry the dasheens in the open they should be given very free ventilation under cover for a week or more before being placed under closer conditions.

#### CLEANING AND GRADING.

The entire cleaning of dasheens may be done in the field, either on the ground or on a bench (fig. 13); or the tops may be cut or



FIG. 13.—Cleaning and grading dasheens at a bench in the field. The dasheens, with the clumps broken apart and the tops cut off, are brought to the bench in field crates. (126276FS.)

roughly broken off, the soil removed, and the dasheens carried in suitable trays to a shed or other place for further cleaning. The irksomeness of the constant bending over and the consequent waste of time in cleaning dasheens on the ground amply justify the small expenditure required for the construction of a rough bench or table on which to do the work.

Dasheens for market should be well cleaned; that is, the bases of the leafstalks should be removed entirely from corms and tubers that have borne leaves, and the feeding roots and other loose fiber removed from all. This does not mean that every particle of loose fiber is to be removed, but it does mean that all the roots and enough of the other fibrous matter should be taken off to leave the dasheens in attractive condition for market. Reasonably thorough cleaning

also lessens the danger of heating or decay, by permitting better circulation of air among the dasheens when they are stored or packed for shipment.

When dasheens are to be stored by the grower the bases of leaf-stalks may be left attached, if desirable, until the dasheens are to be used or shipped. In such case, however, these remains of the tops must be allowed to dry out thoroughly beforehand, and the dasheens must not be stored in too deep a layer or with poor ventilation.

In the cleaning of dasheens it is usually best to grade them as they are handled. No satisfactory mechanical grader has yet been devised. At present it seems advisable to make only three grades, as follows: (1) Ovoid tubers not smaller than 3 ounces each and medium-sized secondary corms (see figs. 4 and 5) of good shape; (2) corms of all sizes suitable for market, including large secondary corms; (3) all tubers smaller than 3 ounces, all sizes of decidedly ill-shaped tubers or secondary corms, and all very small or stunted corms. Seed dasheens may be selected from the last grade and the remainder of this material used for the home table or for stock feed. The subject of grading for market is treated in detail under "Marketing."

### STORAGE.

Dasheens can be stored successfully at 50° F., with ventilation. Tubers keep better than corms, and the latter should therefore generally be used or otherwise disposed of as early as practicable. Tubers have been kept for nearly six months (from early December to late May), unsprouted (see fig. 6) and with but slight loss from decay, in a dry basement where the temperature ranged most of the time between 45° and 55° F. Among the tubers were some corms, a few of which were kept in sound condition until nearly the close of the period. These dasheens were shipped in a barrel and were en route for three weeks. They were emptied out upon arrival, replaced in the barrel after being aired for an hour, and kept loosely covered for the entire period during which they were being used. The importance of ventilation in reducing loss of dasheens from storage rots can scarcely be overemphasized.

Experiments in storing corms and tubers in barrels and crates in a commercial storage place at a temperature of about 36° F. show that this degree of cold will kill the buds and that the dasheens will decay while still at this temperature if the period is as long as six weeks or two months.<sup>7</sup>

Dasheens withstand temperatures near the freezing point for a short time without apparent injury; and the wide fluctuations of temperature during the winter in Florida in any ordinary storehouse or other building do not seem to be especially injurious to them until the heat becomes sufficient to induce sprouting. As has been previously stated, however, a curing period of several days with free ventilation at harvest time is essential for successful storage in quantity.

<sup>7</sup> L. L. Harter, pathologist, of the Office of Cotton, Truck, and Forage Crop Disease Investigations, stored small quantities of dasheen tubers at constant temperatures of 32°, 41°, 50°, and 59° F., respectively. At the end of 2½ months the buds of all the tubers that had been stored at 32° and 41° were dead and the tubers spoiled, while all those at 50° and 59° were sound.

Another method of storing dasheens where the quantity is not too large has been used successfully by several cooperators in the South. The entire clumps are lifted after frost, with the bases of leafstalks, the roots, and soil still attached, and placed close together under an open shed. They are covered with soil where necessary as a protection against freezing. Both corms and tubers usually keep perfectly under these conditions while the weather remains cool.

The seasons during which dasheens are usually available on the market in first-class condition without special storage facilities extends from November to about the first of March. By placing in storage under proper conditions the part of the marketable crop for which there is not a demand at reasonable prices at the time of harvest, it is believed that the growers could not only protect themselves in a measure from low prices but considerably increase the length of the season of use. The results of various small-scale experiments give reason to believe that this could be extended to July or later. Obviously, if the demand continued this extension would result in a larger consumption of dasheens.

### MARKETING.

The market for dasheens is as yet limited, principally for the reason that a very small part of our population is familiar with this vegetable. However, the demand is slowly increasing, and, as a supply of uniformly good quality is placed on the market and the best methods of preparation for the table come to be better understood, the use of dasheens will increase more rapidly.

The general question of a market is so vital to the large grower that, if he expects to continue the cultivation of the crop for market, he should give serious attention to the more important phases of the problem. He should know, at least as well as any dealer or consumer, what constitutes good quality, good appearance, and proper packing.

There is a natural tendency for the grower of dasheens to get the crop off his hands with the least possible labor even at a low price and an equally natural desire on the part of the wholesalers to purchase at as low a price as possible. The grower may be reminded, however, that dasheens, perhaps even more than any of the ordinary crops, at present need to be at their best both in quality and appearance in order to sell readily. In introducing a new food, as is being attempted with this vegetable among our American people, it should be first-class in every respect. Even among people of foreign birth who already know the dasheen, the marketing of a high-grade product will unquestionably result in larger consumption. The dealer also may be reminded that, while the purchase of dasheens properly grown and prepared for market is strongly advised, the grower must be paid a price that will compensate him for the added cost of production.

The prices received by growers for well-cleaned dasheens in wholesale quantities have ranged from 4 to 5 cents a pound for No. 1 tubers and for field-run stock—including all except very small corms and very small or ill-shaped tubers—from 2½ to 3 cents a pound.

A bushel of dasheens after a curing period of a few days weighs about 60 pounds, but the weight for equal bulk gradually diminishes

through further loss of moisture to between 50 and 55 pounds. This, of course, puts the late shipper at a disadvantage unless he obtains a higher price per pound.

As the United States Department of Agriculture is frequently asked where dasheens can be obtained, it will often be advisable during the early stages of the development of this industry for growers who have surplus stocks of tubers or corms on hand to inform the department of the quantities they have or expect to have for sale.

#### TESTING THE CROP FOR QUALITY.

The grower of dasheens who expects to market any part of his crop for table use should make cooking tests of a number of corms and tubers from different parts of his field as soon as the crop is sufficiently mature for the purpose. In no case should testing be delayed later than the beginning of harvest. The grower should know that his dasheens are of suitable quality for the table before he makes the first shipment. Either boiled or baked, the corms and tubers when done should be mealy if immediately cut or broken open. Corms recently dug should be cooked by baking, or by parboiling and then baking, in order to avoid having them split open and become water-soaked. (See recipes for "Baked" and "Plain boiled" dasheens, pages 26 and 27.) Dasheens that are not mealy or that otherwise are not of good quality when boiled or baked should not be marketed for human food. To do so will injure the market not only for the grower who ships the inferior dasheens but for all others.

The commonest cause of poor quality is deficient drainage of the land. Prolonged drought, with dying back of the tops, followed by renewed growth of the plants, is also likely to result in the loss of the mealy-cooking character in the parts of corms and tubers formed previously. A stiff soil, such as one containing a large proportion of clay, is a third cause of poor quality.

#### GRADING FOR MARKET.

Careful attention must be given to the external appearance as well as the quality of corms and tubers for market, if the consumption is to be greatly increased. They should have all roots and loose fiber removed, and the tubers should be well graded. Very small corms—those from stunted plants—should never be marketed for table use, as such corms are likely to lack the mealy-cooking character which is essential in dasheens for human consumption. The shipping of field-run dasheens retards the development of the market and should be discouraged by both growers and dealers.

Strictly first-grade dasheen tubers (see fig. 7) are ovoid, smooth, and weigh from 4 to 8 or more ounces each. In addition to these first-grade tubers, the standard market grade may contain small proportions of (1) tubers of perfect form as small as 3 ounces each and (2) slightly irregular tubers weighing from 4 to 10 ounces each. No very small tubers of any shape and no decidedly ill-shaped tubers of any size should be included in the standard market grade.

There is a difference of opinion as to whether the corms and tubers should be mixed in marketing. The wisdom of mixing them in any given instance will depend largely on whether they are to be

consumed within a few weeks or stored for a longer period. The corms do not keep so long as the tubers. Although it is usually better for the growers to keep them separate while in their own hands, there can be no serious objection to mixing them in shipping if the purchaser so desires.

#### PACKING AND SHIPPING.

The freight rates on dasheens are the same as on potatoes. Dash-eens may be shipped in barrels if these are available at reasonable cost, though burlap sacks holding about 150 pounds may be used with satisfactory results if freezing weather is not encountered.



FIG. 14.—A shipment of dasheen corms in standard barrels. Note the holes for ventilation near the tops and bottoms of the barrels. Dasheens also may be shipped satisfactorily in sacks holding not more than 150 pounds when there is no danger of their freezing. (P15871FS.)

Barrels furnish protection from bruising, however, and in a measure also from freezing if fairly tight. Standard barrels holding from 160 to 180 pounds are to be preferred. When both corms and tubers are packed in the same barrel, as is often required in shipping a single barrel of dasheens, it is usually best to distribute the corms among the tubers rather than to put them all at one end of the barrel.

Burlap covers, if securely held by the top hoop, are satisfactory. Barrels that are nearly air-tight should be ventilated (fig. 14) by means of three or four holes one-half to three-fourths of an inch in diameter distributed around the barrel close to the bottom and the same number near the top.

When there is danger that a shipment will encounter temperatures much below freezing for as long as a day or two, the barrels should be lined with one or more thicknesses of paper. Holes should be punched through the paper where it covers the holes bored in the barrel. Paper or straw, or both, may also be placed over the dasheens next to the burlap cover if considered advisable. Barrels of light weight, with spaces between the staves, will sometimes need paper lining when heavier and tighter barrels do not.

Containers other than barrels or sacks may be used for dasheens if strong enough; but ordinary boxes, crates, hampers, or baskets are unsafe for freight shipment of so heavy a product except in car lots. The bushel basket (fig. 15), if strongly constructed, makes a very attractive and convenient package and is especially useful for express shipment of fancy dasheens to small dealers or to con-

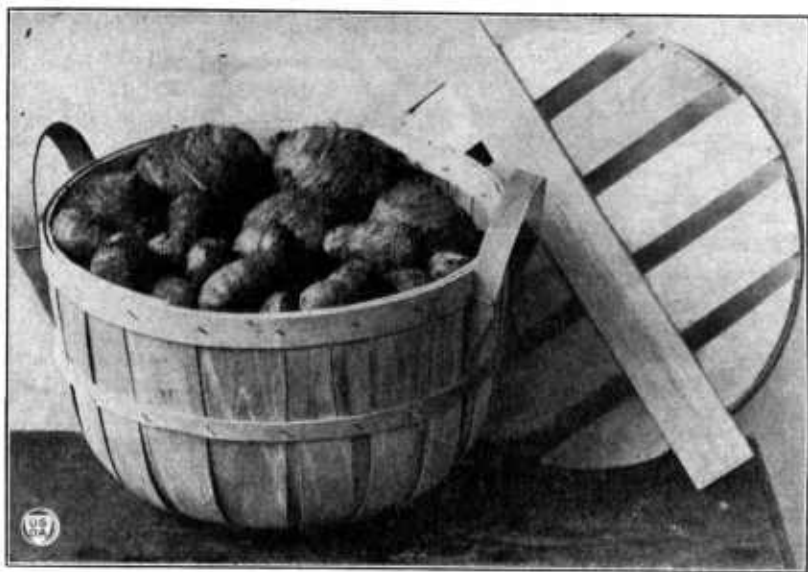


FIG. 15.—An attractive and convenient container for dasheens for express shipment or for freight shipment in carloads. The bushel basket here shown is packed so that both corms and tubers are in evidence. (P24867FS.)

sumers. As the market demand increases, some growers of dasheens may find it worth while to clean and grade their product with extra care, to brand the baskets with their own marks, and to ship this type of package to wholesalers. With a standardized product this would simplify the distributing problem for the wholesale merchant and at the same time insure to the careful grower recognition of the excellence of his dasheens.

Freight shipments to northern cities reached by steamship from the South may be routed by steamer from the port nearest the shipper, in order to reduce the time in transit and danger of freezing and also to lower the cost of transportation.

Dasheens shipped in barrels become moist from sweating during transit, especially if the barrels are rather tight or are lined with paper. They should therefore be emptied out to dry for at least



a few minutes immediately upon their arrival at destination. Any corms or tubers with soft spots should be removed and the remainder then returned to the barrels. If the dasheens are to be kept for a considerable length of time, the barrels should be only loosely covered.

### DISEASES AND INSECT ENEMIES.

Growing dasheens have but few diseases so far as known. Part of these are caused by fungi; one by a bacterium; and one, known as root-knot,<sup>8</sup> is caused by a minute eelworm, or nematode. Thus far only the eelworm disease has become very serious.

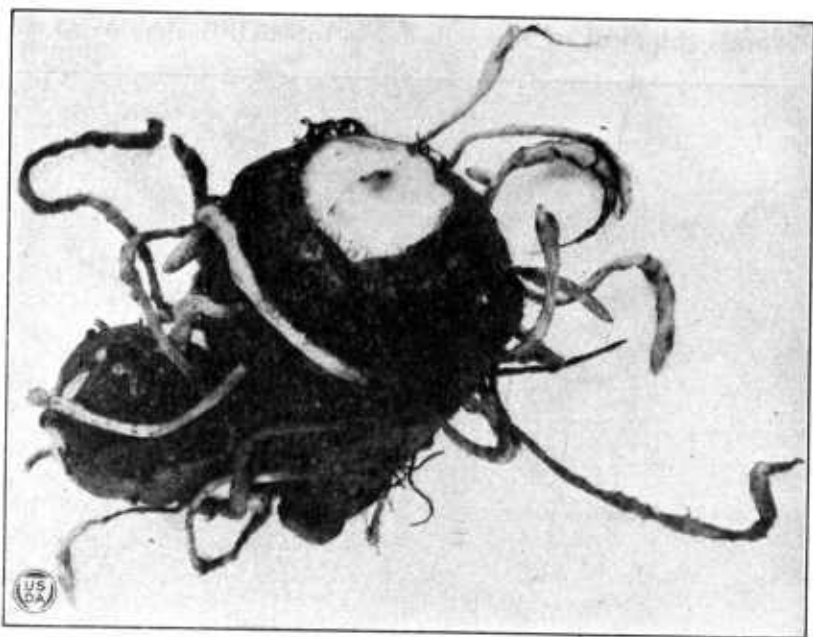


FIG. 16.—Dasheen tubers (reduced) with the attached feeding roots badly diseased with root-knot. The swollen places indicate where colonies of the root-knot nematode are at work inside the roots. The tubers in this case, on account of excellent growing conditions and perhaps light original infestation, do not show marked injury. (P141027S.)

#### ROOT-KNOT.

The common root-knot nematode attacks both the feeding roots (fig. 16) and tubers (fig. 17) of the dasheen, causing characteristic knots, or galls, on the roots and wartlike swellings on the tubers. The galls on the roots interfere with the nutrition of the plant and ultimately kill the part of the root beyond the gall. The swellings, or "sores," on the tubers distort and stunt them and when the infestation of nematodes is severe render the tubers unfit for market, as well as making them more subject to decay in storage.

Dasheen plants that are badly affected with root-knot often have stunted leaves, especially where the soil is light and infection has

<sup>8</sup> Byars, L. P. A nematode disease of the dasheen and its control by hot-water treatment. *In* *Phytopathology*, v. 7, p. 66. 1917.

taken place early in the season. Generally speaking, the lighter the soil, the more severe are the effects of root-knot. The disease can be controlled<sup>o</sup> by taking seed tubers from only such plants as show no root-knot infection at the time of harvesting and planting them in land that is free from the nematode. Each grower of dasheens should save his seed tubers from his own plants, provided he has any that appear to be free from root-knot.

Dasheens slightly diseased with root-knot may be treated with hot water (122° F.) to kill the nematodes while the tubers are dormant without seriously affecting the vitality of the latter. Any tubers intended for seed that are even suspected of being infested with nematodes should be treated, especially if they are to be planted in land not known to be already infested. The following directions for treatment have been prepared by the Office of Cotton, Truck, and Forage Crop Disease Investigations:

Immerse the tubers for a period of 40 minutes in water kept at a temperature of 122° F. If the temperature of the water falls below this for more than a few moments the nematodes may not be killed; and if it rises above 126° the tubers may be injured.

A rather large volume of hot water is desirable, and an accurate thermometer should be kept suspended in it so that the temperature can be determined instantly at any time during the treatment. The temperature may be regulated by keeping a low fire under the vessel or by adding hotter water when needed and cold water when the temperature rises above the danger point.

Dasheens should be treated while dormant, since after they begin to sprout they are more easily injured by the hot water. For this reason, when they are not planted very early, it is advisable to treat the tubers several weeks in advance of planting.

To avoid danger of introducing the root-knot nematode into land not already infested with it, all dasheens to be planted should be treated as above unless they are known to have been carefully examined at the time of digging and the fibrous feeding roots found free from all evidence of this disease. This examination, to be of value, must be made of the fresh roots, for it is only then that the characteristic knots, galls, or swellings are easily and certainly recognized. Examination of the tubers at any other time is useless unless the infestation with nematodes is severe enough to cause distortion. The nematode causing root-knot is a minute cee worm, which can not be seen without a lens; only its effects on the tubers or fibrous roots are visible to the unaided eye. When the disease is severe, most of the fibrous roots of the dasheen are noticeably swollen at one or more places, a condition caused by colonies of nematodes within the roots at those places; and in an advanced



FIG. 17.—A small dasheen tuber (natural size) distorted by severe nematode infestation. The numerous swellings on the lower half are caused by colonies of the nematodes. Compare this tuber with the smooth healthy ones shown in Figure 7. (P19307FS.)

<sup>o</sup> Demonstrated by experiments conducted by Dr. L. P. Byars, formerly Pathologist, Office of Cotton, Truck, and Forage Crop Disease Investigations, United States Department of Agriculture.

stage of the disease many of these roots rot off at one of the swellings, leaving the stubs still attached to the tubers. Some of the lateral tubers from such plants are usually found to be of distorted shape and unhealthy appearance, caused by the nematodes in them; these tubers often decay within a few weeks if stored. Such severely infested tubers should not be used for planting, even if treated.

It is advisable to plant dasheens only on land free from root-knot when possible or on land which has been rotated for one or more years with root-knot resistant crops, such as corn, small grains, velvet beans, and resistant varieties of cowpeas. For a full discussion of the root-knot disease and a list of resistant crops, see Farmers' Bulletin 1345.

#### STORAGE ROTS.

When dasheens are stored before they have dried out or cured sufficiently, they are likely to be attacked by one or more of several storage rots.<sup>10</sup> Careful handling of the dasheens, adequate curing in the open air before storing, and proper temperature and ventilation of the storage place are the means of preventing serious loss from these causes.

#### INSECT ENEMIES.

The dasheen is attacked by a few insects, but so far only one appears to be menacing in this country. The leaves are eaten to a very slight extent by various grasshoppers and a few hairy caterpillars; aphids, or plant lice, also suck the juice from the leaf blades; and in a few instances a mealybug has been found in considerable numbers on the bases of the petioles. When tubers are kept stored at ordinary temperatures until the weather becomes warm in the spring, the sprouts which develop are likely to be severely infested with aphids. While this is undesirable, it does not seem to injure the tubers for planting, provided the planting is not deferred too long and the insects are not too numerous. It is advisable, however, to rid the sprouts of such infestation before planting, by treatment with hot water (122° F.) or a strong soap solution. One of the red spiders occasionally attacks the older leaves of dasheens, especially during very dry weather.

The one insect pest which threatens to become at all serious is a smooth black or dark-brown boring caterpillar, the larva of a moth.<sup>11</sup> This borer usually attacks only the corms, though sometimes it bores into one or more of the lateral tubers. In some cases the total length of the burrow in one corm is equal to only once or twice the diameter of the corm, but occasionally a corm is found that has been honey-combed (fig. 18) with burrows made by one or more of these caterpillars. In emerging from the corm, the borer sometimes works up into the lower part of the petiole of the leaf, but often it leaves the corm at one side. It then forms a cocoon in the ground. A number of these brown cocoons, about three-quarters of an inch in length, will usually be found in the soil in harvesting a crop of dasheens. No thoroughly effective plan of procedure against this pest has yet been suggested, but the destruction of the cocoons or larvæ found during harvest will doubtless tend to reduce the number the following season.

<sup>10</sup> Harter, L. L. Storage-rots of economic aroids. *In Jour. Agr. Research*, v. 6, p. 549-572, 1 fig., pl. 81-83. 1916. Literature cited, p. 571.

<sup>11</sup> This has been identified by Dr. F. H. Chittenden, Bureau of Entomology, as *Sphida obliqua* Walk.

## USES.

Three different products are obtained from the dasheen plant: (1) The corms and tubers, containing principally starch and protein, are used like potatoes; (2) the young green leaves are cooked as greens (see p. 33 for special directions); and (3) the blanched young shoots, obtained by forcing<sup>12</sup> corms in the dark, furnish a tender vegetable having a flavor somewhat similar to that of mushrooms.

## CORMS AND TUBERS.

## PREPARATION FOR THE TABLE.

Good dasheens, well cooked, are mealy and have a delicate nutty flavor. They are drier and firmer than potatoes, containing about one-half more of nutrient materials. The flesh may remain white when cooked or may become cream colored, gayish, or violet; the corms usually become darker than the tubers. The corms (see figs. 2 and 3) commonly weigh from three-fourths of a pound to 3 pounds each, but occasionally they are much larger. Grown under proper conditions, the corms when cooked are somewhat drier, more mealy, and richer in flavor than the lateral tubers (see figs. 3 and 6), although not quite so fine in texture or so white. For many dasheen dishes, corms and tubers are equally well suited, while for a few dishes one type or the other is preferable. In the recipes which follow it is assumed that dasheens of good quality are available; but, as with other vegetables, it is to be expected that at the best an occasional poor specimen will be found.

As with any new food product, it is important when one is eating dasheens for the first time to have them prepared and served just right. For persons who have become familiar with the vegetable no greater care is required than in preparing potatoes. Being a somewhat drier and more concentrated food than potatoes, dasheens will absorb a larger proportion of butter; but if eaten more slowly, as they should be, an excessive quantity of butter is not required. Baking is one of the best methods to use for a first trial of dasheens, provided they can be served and eaten promptly; in this way the flavor and other qualities are likely to be more natural.

Dasheens require a little less time for cooking than potatoes of equal size; this is especially important to remember in baking. For ordinary baking or boiling they should be cleaned dry with a stiff brush or coarse cloth and then rinsed in water. The scraping of



FIG. 18.—Dasheen corm riddled by a boring caterpillar which attacks the growing dasheen and emerges from the corm usually about harvest time. (P19311FS.)

<sup>12</sup> Young, Robert A. Forcing and blanching dasheen shoots. U. S. Dept. Agr. Cir. 125, 6 p., 5 fig. 1920.

dasheens is not advised when brushing will serve. If it is desired to scrape them, handle them dry, in order to avoid possible temporary irritation to the hands. In washing the hands after scraping, it is well to add a teaspoonful of washing soda (sodium carbonate) to the quart of water. Soda is seldom necessary in washing the hands after ordinary paring, if the dasheens are handled dry.

#### RECIPES.<sup>13</sup>

*Baked dasheens.*—The cleaned corms or tubers may be put directly into a moderate oven—about the same as for potatoes; or, they may first be par-boiled 5 to 10 minutes (depending upon size). To facilitate baking, very large dasheens (corms) may be cut in half—always lengthwise. Do not overbake. Parboiling hastens cooking and lessens the possibility of waste from the formation of a hard crust in baking. Test with a fork or by pressure with the fingers. When done, the dasheens should be served promptly in a warmed dish covered with a napkin, and eaten without delay. Season with salt and butter.

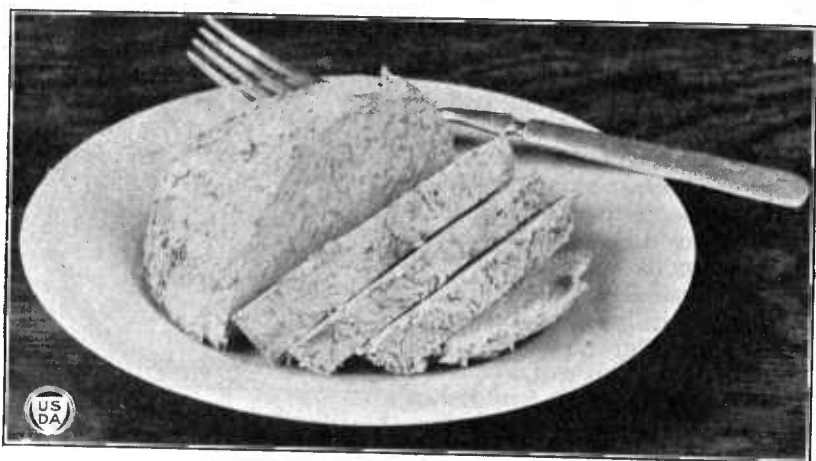


FIG. 19.—Half of a baked dasheen corm peeled, sliced, and ready to serve. Boiled corms may be served in the same manner. A warmed plate or dish (preferably covered) should be used and the dasheen served very promptly after being peeled. Lengthwise slicing of the corm is best. The advantage of having the fibrous skin removed before serving the corm is obvious. (P25793FS.)

If the dasheens are well cleaned beforehand and are not overbaked, the light crust formed will be found especially palatable.

A hot oven may be used in baking dasheens, but in such cases it is necessary to prick the skin after the tubers have been in the oven about 10 minutes, in order to prevent their bursting. With a hot oven the time of baking should, of course, be shortened.

Baked corms, a pound or more in weight, may be served in the "half shell," with a piece of butter placed in the center of the cut surface. Another method is to remove the baked skin from each half corm, place the half on its flat surface, and slice it down, lengthwise, in half-inch slices (fig. 19); serve very promptly, in a warm dish, preferably covered.

Pared or scraped dasheens (handled dry, as previously directed) may be cooked in one of three ways: (1) Roasted with meat, (2) rubbed with fat and baked, (3) immersed in nearly boiling water long enough to heat through and baked. With the last two methods a particularly delicious soft crust is

<sup>13</sup> The original dasheen recipes which furnished a basis for the subsequent studies resulting in those published here were formulated in 1909-1910 in the Department of Home Economics of the University of Tennessee, by Miss Louise G. Turner, Assistant, through the courtesy of Miss Catharine A. Mulligan, then Dean of Women. Studies of methods of preparation of dasheens have been conducted also by the Bureau of Home Economics.

formed, provided the dasheens have not been baked either too quickly or too long.

*Plain boiled dasheens.*—Place the whole dasheens, unpared, in hot water (salted or fresh) and boil until done—not longer than for potatoes of equal size. Pour off water immediately upon removal from the fire, and if practicable place the dasheens in the oven for a few minutes to dry off. Serve hot, in a warmed dish covered with a napkin, and eat at once with salt and butter or gravy. If desired and it does not involve delay, boiled dasheens may be peeled before being placed on the table. (Fig. 20.) Large corms are conveniently served peeled, cut lengthwise into halves, and the latter sliced as suggested for baked corms and as shown in Figure 19. It is usually better during the autumn and early winter to parboil dasheen corms for only 10 minutes and then hake, as the corms split open and become water-soaked if cooked entirely by boiling at any time within a month after they are dug. This applies to the corms only, not to the tubers.

*Boiled and buttered.*—Small tubers are especially good if, immediately after being boiled and peeled, they are placed in the oven just long enough to melt.

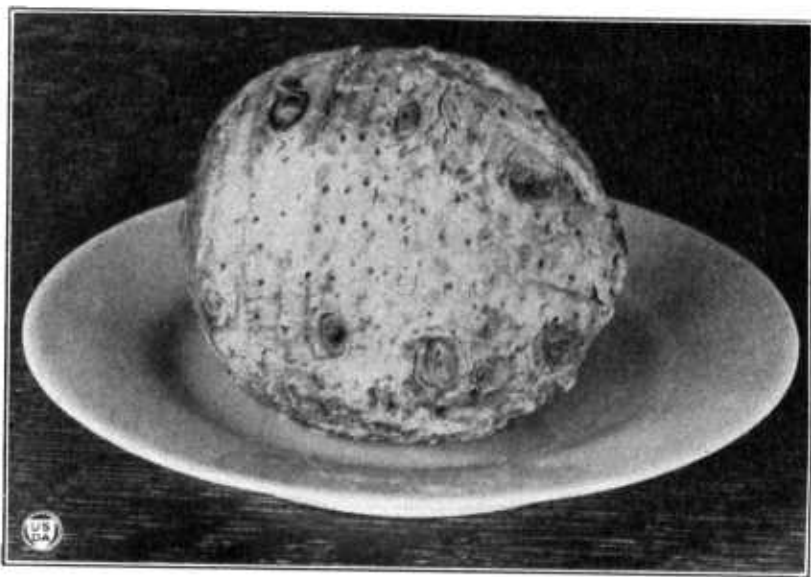


FIG. 20.—Dasheen corm boiled and peeled, showing the root scars and buds on the surface after the removal of the thin fibrous skin. As is evident from the illustration, dasheens may be prepared for the table without waste. With suitable seasoning (the same as used for potatoes) the corm as shown is ready to eat. (P25035FS.)

a dressing of butter over them. When so prepared, if kept in a warm place, they are less likely to become soggy from standing.

*Fried dasheens.*—(1) Boiled dasheens, either warm or cold, may be peeled, cut into thick, even slices, salted, and fried (sautéed) quickly, one layer deep, in a covered frying pan. Fry only until very slightly browned on each side; remove from the fire at once and serve. If the dasheens are very dry, add one or two tablespoonfuls of water before frying and keep the pan closely covered.

(2) Small tubers are very good boiled, peeled hot, and fried lightly either whole or in halves. The frying should be done immediately following the boiling.

(3) Pare raw tubers and cut lengthwise into eighths; soak in water for a few minutes, drain, sprinkle with salt, and dredge liberally with flour; fry slowly to a straw color, with a moderate quantity of fat (not deep fat) in a closely covered frying pan, stirring the slices occasionally. This method gives a most delicious dish and one that is quickly prepared.

*French-fried dasheens.*—French-fried dasheens are exceedingly good if not fried so long as to make them too dry; they require less time than potatoes.

**Fried dasheen cakes.**—These cakes are made like the taro cakes of Hawaii. They are very delicious and are especially recommended for use when it is desired to serve dasheens on short notice. Boil the dasheens in their skins, peel, and "rice" or mash while warm. Season with salt and a little butter (add no milk). With the hands moistened, mold into small cakes to be fried when required.

**Dasheen cheese cakes and fish cakes.**—Boiled dasheens riced or mashed while hot may be combined with cheese or with canned or shredded fish or left-over fish, made into cakes or croquettes, and fried.

**Riced dasheen.**—Boil (or parboil and bake) the dasheens in their skins. Remove the skin immediately, rice the dasheen into a heated dish, and proceed in one of the following ways:

(1) Stir in the desired seasoning, such as butter and salt, and serve in a warm, covered dish. Butter may be omitted if gravy is to be used. Milk or cream may be beaten in if desired, but prepared in this way the dasheens will not be so light.

(2) Empty the riced dasheen in layers into a warmed serving dish (fig. 21), seasoning each layer. Do not stir.

(3) Season the riced dasheen as desired and put into a baking dish with a liberal quantity of butter on top. Bake for 8 to 10 minutes and serve.

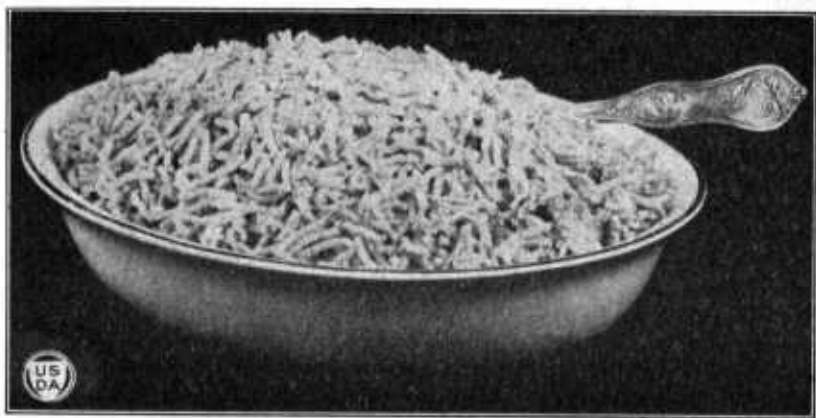


FIG. 21.—Riced dasheen ready to serve. The dasheens—corms or tubers—are boiled in their skins and peeled and riced while hot. This is an excellent way to serve boiled dasheens. (P25789FS.)

In ricing dasheens the round, or plunger, type of ricer rather than the triangular lever type should be used. One with steel handles is better than one with cast-iron handles, which are too easily broken, especially in ricing corms.

**Filling for fowl and other meats.**—In preparing dasheen filling, about two-thirds of the usual quantity of bread is replaced with dasheens (boiled in their skins), riced or well mashed. Season as desired. Dasheen filling is mealy and compares favorably with chestnut filling.

**Dasheen hash.**—Prepare from cold boiled or baked dasheens, with meat and seasoning as for ordinary hash.

**Dasheen flakes or granulated dasheen.**—This recipe should become familiar to every one who uses dasheens, because it furnishes a means not only of utilizing cold dasheens but also of preparing a most excellent dish on very short notice. Use dasheens boiled or baked one or more days previously. Corms are especially well suited because of their meanness, but tubers also may be used. Peel the dasheens and grind them with a food chopper with nut-butter grinder or other fine adjustment into a chafing dish or covered vessel which can be placed in the oven. If the dasheens are very dry, a spoonful of water put in the dish before grinding will help to prevent scorching. Salt the dasheens while grinding and, without stirring or adding anything else, heat and serve promptly. Do not permit the dish to steam uncovered. Eat with butter or gravy. The recipe may be varied by grinding cheese with the dasheens or by sprinkling the top with grated cheese and browning slightly at the last.

*Scalloped dasheens.*—Pare and slice raw dasheens, putting the slices in layers into a buttered baking dish, and seasoning each layer with butter, salt, etc. The addition of a few thin slices of onion brings out the dasheen flavor. Lattice-work slices of dasheen (fig. 22), made with a fluted slicer, are a little more attractive in appearance than the plain ones, and they do not mat together. Nearly cover with rich milk, and bake. Scalloped dasheens require only about two-thirds as much time in cooking as scalloped potatoes. When corms are used for scalloping, it is well to discard about three-quarters of an inch of the upper, or bud end, as it may be tough after cooking. On account of the firm texture of the dasheen, a slicer with the sliding guard made of wood rather than of tin is desirable if a fluted slicer is used.

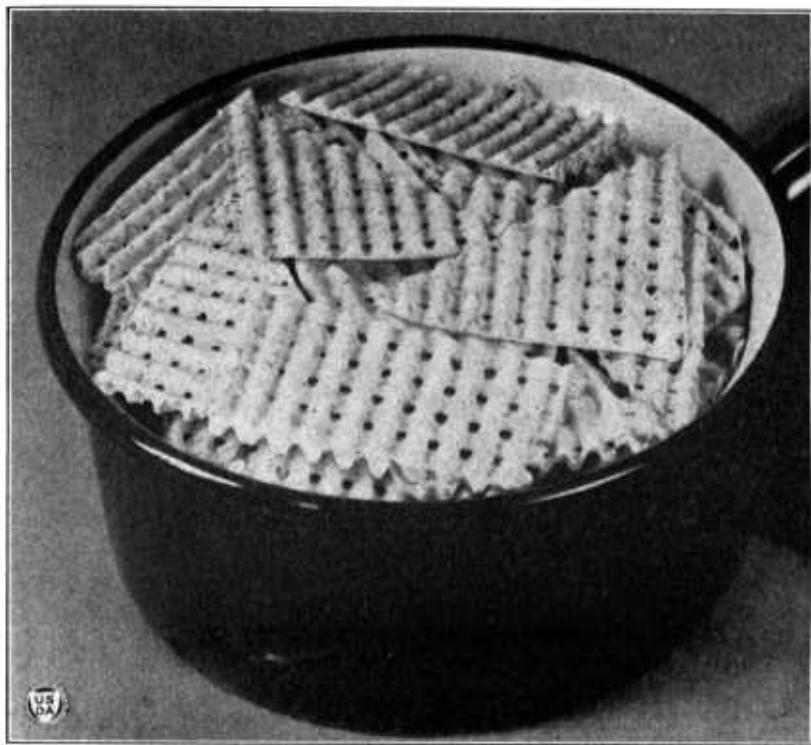


FIG. 22.—A casserole of sliced dasheens ready for seasoning and the addition of milk for scalloping. Lattice-work slices are made with a fluted slicer, but plain slices may be used. Dasheens also may be scalloped with grated cheese and bread crumbs. (P15892FS.)

This method of serving the dasheen will be found particularly well suited for banquets or formal dinners, and in such cases individual baking dishes or casseroles should be used if practicable.

*Dasheens scalloped with cheese.*—Proceed as for scalloped dasheens, but use less butter and add grated cheese. Add bread crumbs to the top layer.

*Dasheen chips, Saratoga style.*—Dasheen chips (fig. 23) are made in the same way as potato chips. Tubers are much better than corms for making chips. Pare raw dasheens without wetting them. Slice evenly about one-sixteenth of an inch thick and soak in plenty of water for one to two hours, changing the water at least once. Dry the slices between cloths and fry in deep fat to a straw color. Place the chips on paper so that the excess fat may be drawn from them. Salt immediately when taken from the hot fat. The chips will keep for some time without becoming rancid if fried in a good vegetable fat or oil.

*Dasheen crisps.*—Dasheen crisps (fig. 24) are especially recommended. Large tubers are usually best for this purpose, but corms of mealy cooking



quality are entirely satisfactory. The crisps are made by cutting pared raw dasheens into latticework slices, as for scalloped dasheens, soaking for an hour or more in at least two changes of water, and frying slowly to a straw color in deep fat. Drain on paper and salt immediately. The use of vegetable fats or oils is advised.

Except in a very moist atmosphere, dasheen crisps and chips retain their crispness for several days without reheating.

*Dasheen salad.*—One of the best ways of serving dasheens is as a salad, especially if the dasheens are to be prepared some time in advance or if the number of persons to be served is large. Dasheen salad is prepared like potato salad except that with dasheens the tubers (boiled in the skin) are partially chilled in cold water as soon as done, in order to prevent their becoming too dry and mealy; the salad is then prepared immediately. Tubers, being a little moister than corms, are usually preferred for salad.

*Stuffed dasheens.*—Proceed as in baking. When the dasheens are done, follow the method used for stuffed potatoes, except that more butter is used.



FIG. 23.—Dasheen chips, Saratoga style. Dasheen chips are made in the same way as potato chips. They do not absorb as much fat as potato chips and have a distinctive nutty flavor. Tubers are more suitable than corms for making chips. (126228FS.)

If moistened with cream instead of milk, still better results follow. Grated cheese also may be mixed with the dasheen or sprinkled on top, as in the case of the half corms shown in Figure 25.

Corms are especially adapted for serving in this manner; they may be scraped or simply scrubbed, as preferred, and unless much smaller than a pound in weight they may be cut in half—always from the top to the base. Instead of mashing dasheens it will be found better to put them through a potato ricer. After baking, any part of the corm found to be hard should be discarded.

*Dasheen corms stuffed with meat.*—Corms 3 or more inches in diameter are used for this purpose. Clean the corm thoroughly, by scraping or with a stiff brush. Cut the base off squarely so that the corm will stand upright. With the aid of a paring knife and an apple corer cut a cylindrical hole at least  $1\frac{1}{2}$  inches in diameter, from the top to within three-quarters of an inch of the bottom; save the top of this core to plug the top of the cavity. Hollow out the interior of the corm to make additional space for the filling, leaving the walls at least one-half inch thick. Parboil for 10 minutes in water that is well salted. Fill with cooked chopped meat, well seasoned and with plenty of fat, and replace the plug. Bake in a moderately slow oven until done. Do not overbake. Serve immediately, cutting the corm downward into halves, quarters, or smaller portions.

*Dasheen pancakes.*—Excellent pancakes are made by using one part of grated raw dasheen to one, two, or three parts of wheat flour, with the other ingredients as usual.

*Dasheen fritters.*—

- |   |                                    |
|---|------------------------------------|
| 1 cup of grated or finely ground raw dasheen. | $\frac{1}{2}$ teaspoonful of salt. |
| 1 cup of white flour.                         | 2 teaspoonfuls of baking powder.   |
| 1 tablespoonful of sugar.                     | $\frac{1}{2}$ cup of milk.         |

Mix the dasheen and the dry ingredients and add the milk. Drop heaping teaspoonfuls into deep hot fat and fry to a golden brown. Sprinkle with powdered sugar and serve immediately, or serve with maple or sugar sirup. These fritters make one of the most delicious of all dasheen dishes.

*Creamed dasheens.*—Tubers are usually better than corms for creamed dasheens, because they are slightly moister and are more often without violet coloration. Mealy cooking corms are satisfactory, however, if they do not darken much when cooked. Boil the dasheens in their skins, peel, dice, season

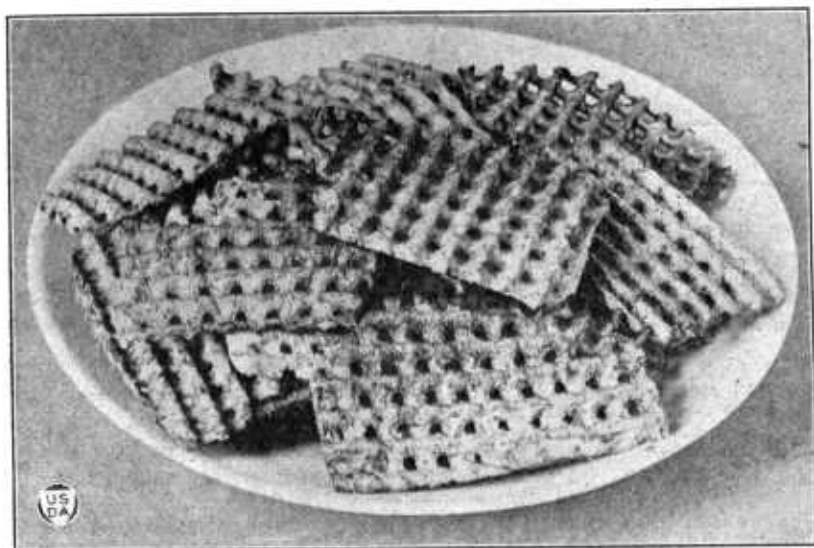


FIG. 24.—Dasheen crisps. An especially attractive and delicious product made by slicing raw dasheens with a fluted vegetable slicer and frying in deep fat. (P15767a-F.S.)

with salt, and nearly cover with milk. Heat slowly and simmer until the milk is mostly absorbed. A sauce made with flour is not used, since sufficient starch to thicken the milk is drawn from the dasheens in the slow cooking. Cold boiled tubers also may be used in preparing creamed dasheens, but they require even slower cooking. This recipe is recommended for use only after dasheens have been tried in other ways.

*Dasheen soup.*—

- |                          |                                     |
|--------------------------|-------------------------------------|
| 3 cups of boiling water. | 3 tablespoonfuls of butter.         |
| 3 cups of milk.          | Salt and celery salt to taste.      |
| 3 cups of riced dasheen. | Parsley or grated onion if desired. |

Boil and rice the dasheens as described. Into a double boiler put the boiling water and add the milk and dasheen. Bring to a boil and cook for 5 to 10 minutes. Season and serve.

*Candied dasheens.*—Peel parboiled dasheens and cut into thick slices or strips. Prepare a sirup made in the following proportions:

- |                      |                                  |
|----------------------|----------------------------------|
| 1 cup of sugar.      | 2 to 3 tablespoonfuls of butter. |
| 2 cups of hot water. | Salt to taste.                   |

Either granulated or brown sugar may be used. Cinnamon may be added if desired. Boil the dasheen slices or strips in this sirup in a covered dish until soft, and brown in the oven.

This dish is very similar to the candied sweet potatoes so commonly served as one of the vegetables to accompany roast meats and fowl.

*Dasheen bread.*—Make the bread in the usual way; but replace one-fourth or one-third, by measure, of the wheat flour with boiled and riced or mashed dasheen. The dasheens should always be boiled in the skin. The bread, which is much like that made with potato in a similar way, is usually a little darker than when made from all wheat; but the texture and flavor are excellent, and the bread does not dry out so quickly.



FIG. 25.—Stuffed half of a dasheen corm. Corms of a pound or more in weight are best for use in this way. The corm is first baked and the contents removed and seasoned. This is one of the most attractive of the many dasheen dishes. (1259201'S.)

*Dasheen pie.*—Any recipe for sweet-potato pie will probably do, but the following is suggested as being economical and otherwise satisfactory. The dasheens should be boiled and riced as usual.

2 cups of riced dasheen.	1 egg (white and yolk beaten separately).
$\frac{1}{2}$ cup of butter.	2 cups of milk.
$\frac{3}{4}$ cup of white sugar.	$\frac{1}{2}$ lemon, juice and rind.
$\frac{1}{2}$ teaspoonful of cinnamon.	
$\frac{1}{2}$ teaspoonful of nutmeg.	

Bake in a deep pie tin. Serve warm.

*Dasheen pudding.*—Proceed the same as with the above recipe for pie. Bake without crust in a deep dish well buttered.

#### LEAVES AND LEAFSTALKS AS FOOD.

Dasheen leaves and leafstalks are useful as vegetables, cooked in the same way as other greens except that parboiling with baking soda is required to destroy their acidity unless cooked with fat meat (see recipe). They have much the same food value as other greens. Dasheen leaves may be made a very valuable green vegetable in the South, especially for late summer and fall use. Indeed, the plant will furnish greens for the home table in regions where the season is too short to raise a crop of corms and tubers. Where the tuber crop can be grown the cutting of the leaves will naturally tend to reduce the crop, but if only one leaf at a time is removed from a plant and not too many during the season the loss in the size of the

tuber crop will not equal the value of the leaves as greens. If the dasheen crop is harvested before frost, an abundance of unopened leaves is obtained at that time without detriment to the crop. Leaves not yet unrolled or only partly unrolled (fig. 26) are more tender than the open ones, but while the plants are growing rapidly even the fully expanded leaves are quite satisfactory. Because of their acidity, dasheen leaves should never be eaten raw.

*Dasheen greens.*—Remove half or more of the midrib of fully opened leaves and use the unopened ones entire. Cut into pieces and boil for 12 or 15 minutes in water to which a large pinch of baking soda has been added. Drain off the soda water, wash with clear boiling water, and then boil in water seasoned with salt for 20 to 30 minutes or until tender and the acidity is destroyed. Butter and other seasoning may be added as desired.

Boiling in soda water to help destroy the acidity has usually been found unnecessary when the greens are cooked with fat meat.

The petioles, or leaf-stalks, are also cooked and eaten. The skin of older stalks is removed, but this is not usually necessary with very young ones. They are cut into short pieces and cooked in the same way as the leaf blade; they may be cooked with the leaves or separately. The stalks cooked with lemon juice have suggested to some persons the taste of rhubarb.

#### DASHEEN SHOOTS.<sup>14</sup>

Blanched dasheen shoots can be prepared for the table in much the same way as the leafstalks of Swiss chard. They are obtained by forcing the corms in the dark during the winter or early spring. In the North this may be done either on a bench with bottom heat or under a bench without bottom heat. A space above the corms must be tightly inclosed to exclude light. In the far South the corms may be planted close together in rows in sandy soil and the shoots blanched by keeping the soil ridged above them as they grow. As much as



FIG. 26.—Young dasheen leaf at a proper stage for use as a green vegetable. Such leaves make excellent greens for summer and autumn use. They are very acid when raw, however, and require special cooking to destroy this property. (P19218FS.)

<sup>14</sup> More detailed directions for the production of the blanched dasheen shoots are given in Department Circular 125, which may be obtained free upon request to the United States Department of Agriculture, Washington, D. C.

a month may elapse after planting the corms before the first cutting of shoots can be made, but from four to six additional cuttings may be made at intervals of about 10 days.

*Dasheen shoots on toast.*—Cut the shoots into 2-inch lengths, pour on an abundance of boiling water, add salt, and boil for 12 minutes; drain, pour on enough cold <sup>15</sup> milk so that the shoots will be completely covered while boiling, season with salt, and boil for 5 minutes; drain, season with butter, and serve on toast or plain. Cream sauce may be used in serving, if desired.

*Dasheen shoots with bacon.*—Instead of boiling in milk after draining off the first water, add a small piece of bacon or other fat meat <sup>16</sup> and then cover the shoots with cold water, season with salt, and boil for 5 minutes. Drain and serve.

#### STOCK FEED.

Many farmers have found dasheens in conjunction with other feeds a valuable feed for cattle, hogs, and chickens. Small or odd-shaped tubers not suitable for market and not required for any other purpose, as well as corms, are used. The adding of dasheens to the feed of milk cows is reported to have been followed by increased milk production, and with laying hens to result in greater egg production. For the latter the dasheens are usually cooked, though sometimes the raw ones are fed, ground or finely cut. Sheep are also known to eat dasheens freely, and even horses sometimes eat them. Being too low in protein and in fat for a balanced ration alone, the use of some grain or other more nitrogenous feed is ordinarily required with dasheens. However, reports have been received of instances in which hogs have been fattened satisfactorily on dasheens almost alone.

Except for chickens, dasheens usually have been fed raw, but most animals will eat them more freely if partly cooked. A very few cases have been reported in which the feeding of raw dasheens to pigs resulted in the mouths of the animals becoming sore, but other farmers have stated that there was no such occurrence in their experience. No conclusive scientific experiments with dasheens in stock feeding have yet been made, and the question of how best to feed them and in just what proportion to other feeds can not be definitely answered at this time. The practice among farmers as a rule has been to give the animals as many dasheens as they will eat in addition to other immediately available feeds.

#### INDUSTRIAL USES OF DASHEENS.

*Flour.*—Dasheens, especially the corms, may be converted into flour which is excellent for use in a variety of ways, such as in soups and gruels and also with wheat or rye flour in pancakes, crullers, biscuits, and bread. About one-fourth the original weight of the dasheens is obtained in flour. Considerable interest has arisen at various times over the possibility of developing an industry in the production of dasheen flour, but most of the attempts that have been made to this end have been at too great a distance from the source of supply to give real opportunity for commercial success. On account of the high water content of the dasheen as compared with that of the cereals, it would be essential to establish such a business close to a

<sup>15</sup> The purpose in using cold milk or water after the first boiling is to prevent the shoots from becoming too soft.

<sup>16</sup> The fat of the milk or meat seems to assist in destroying the acidity.

center of dasheen production. No attempts, so far as known, are at present under way to manufacture the flour.

*Starch.*—Because of the extreme smallness of the starch grain of the dasheen and of the mucilaginous character of the juice, the separation of the starch is not commercially possible by any ordinary process. However, as a result of tests made by a commercial specialist with small quantities of starch separated experimentally, it is stated that it would have undoubted value as a sizing for textiles. The results obtained were stated to be different from those obtained with either potato or cassava starch. It is estimated that the commercial value of dasheen starch for this purpose would be about the same as that of potato starch.

*Industrial alcohol.*—The question of the production of industrial alcohol from dasheens for which there is no other market has often been raised, and recently some experiments have been made by a new process to determine whether or not this is feasible. The conclusion was that so long as waste molasses from sugar mills is available, alcohol from dasheens could by no means compete with that from the sugar-mill product.

*Chips.*—Mention has been made under "Recipes" of dasheen chips, prepared in the same manner as Saratoga potato chips. Attempts to manufacture dasheen chips commercially have been partially successful, and it seems probable that at least a small industry in the production of these chips will develop eventually. Only the tubers, and those of the best quality and of rather large size, can be used satisfactorily for this purpose, however. Attempts to use corms, small tubers, or those of somewhat inferior quality have given poor results. A small quantity of commercially made chips recently was placed on the market by a local firm in Jacksonville, Fla., near which there is a considerable dasheen-growing industry.

# **ORGANIZATION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE.**

April 22, 1924.

<i>Secretary of Agriculture</i> .....	HENRY C. WALLACE.
<i>Assistant Secretary</i> .....	HOWARD M. GORE.
<i>Director of Scientific Work</i> .....	E. D. BALL.
<i>Director of Regulatory Work</i> .....	WALTER G. CAMPBELL.
<i>Director of Extension Work</i> .....	C. W. WARBURTON.
<i>Solicitor</i> .....	R. W. WILLIAMS.
<i>Weather Bureau</i> .....	CHARLES F. MARVIN, <i>Chief</i> .
<i>Bureau of Agricultural Economics</i> .....	HENRY C. TAYLOR, <i>Chief</i> .
<i>Bureau of Animal Industry</i> .....	JOHN R. MOHLER, <i>Chief</i> .
<i>Bureau of Plant Industry</i> .....	WILLIAM A. TAYLOR, <i>Chief</i> .
<i>Forest Service</i> .....	W. B. GREELEY, <i>Chief</i> .
<i>Bureau of Chemistry</i> .....	C. A. BROWNE, <i>Chief</i> .
<i>Bureau of Soils</i> .....	MILTON WHITNEY, <i>Chief</i> .
<i>Bureau of Entomology</i> .....	L. O. HOWARD, <i>Chief</i> .
<i>Bureau of Biological Survey</i> .....	E. W. NELSON, <i>Chief</i> .
<i>Bureau of Public Roads</i> .....	THOMAS H. MACDONALD, <i>Chief</i> .
<i>Bureau of Home Economics</i> .....	LOUISE STANLEY, <i>Chief</i> .
<i>Fixed Nitrogen Research Laboratory</i> .....	F. G. COTTRELL, <i>Director</i> .
<i>Office of Experiment Stations</i> .....	E. W. ALLEN, <i>Chief</i> .
<i>Library</i> .....	CLARIBEL R. BARNETT, <i>Librarian</i> .
<i>Publications</i> .....	L. J. HAYNES, <i>in Charge</i> .
<i>Federal Horticultural Board</i> .....	C. L. MARLATT, <i>Chairman</i> .
<i>Insecticide and Fungicide Board</i> .....	J. K. HAYWOOD, <i>Chairman</i> .
<i>Packers and Stockyards Administration</i> .....	} CHESTER MORRILL, <i>Assistant to the</i>
<i>Grain Futures Administration</i> .....	

This bulletin is a contribution from

<i>Bureau of Plant Industry</i> -----	WILLIAM A. TAYLOR, <i>Chief.</i>
<i>Office of Foreign Seed and Plant Intro-</i>	} DAVID FAIRCHILD, <i>Agricultural</i>
<i>duction.</i>	

36

---

ADDITIONAL COPIES  
OF THIS PUBLICATION MAY BE PROCURED FROM  
THE SUPERINTENDENT OF DOCUMENTS  
GOVERNMENT PRINTING OFFICE  
WASHINGTON, D. C. -  
AT  
5 CENTS PER COPY

